CLAIMS

1. A multi-point communications system comprising:

a head end unit disposed at a primary site, the head end unit including a transmitter for transmitting OFDM/DMT symbols over a predetermined number of bins across a transmission medium, the OFDM/DMT symbols being transmitted in periodically occurring symbol frames, a plurality of the symbol frames each having a predetermined signal superimposed thereon;

a plurality of remote service units each including a receiver for receiving the OFDM/DMT symbols over a subset of the predetermined number of bins from the transmission medium, the receivers using the superimposed predetermined signal to attain symbol alignment of the received OFDM/DMT symbols.

2. A multi-point communications system as claimed in claim 1 wherein the superimposed signal is transmitted at a period equal to the symbol rate.

3. A multi-point communications system as claimed in claim 1 wherein the predetermined signal is an impulse signal.

4. A multi-point communications system as claimed in claim 1 wherein the transmitter of the head end unit varies the polarity of the predetermined signal.

5. A multi-point communications system as claimed in claim 1 wherein each of the periodically occurring formatted symbol frames includes a cyclic prefix.

6. A multi-point communications system as claimed in claim 1 wherein the receivers apply a predetermined incremental phase shift to received samples, including received samples of the predetermined signal, corresponding to the received OFDM/DMT symbols to thereby compensate for phase shifts resulting from the cyclic prefix.

7. A multi-point communications system as claimed in claim 6 wherein the receiver comprises a lookup table to facilitate application of the predetermined incremental phase shift.

8. A multi-point communications system as claimed in claim 1 wherein the receivers attain symbol alignment by collecting digital data samples corresponding to the OFDM/DMT symbols, applying a sliding window of fixed the length to the digital data samples, and computing the total power in the samples of each window to determine which of the sliding

window positions has samples of the greatest total power whereby the window position having the greatest total power corresponds to the time position used by the receiver to align symbols received from the transmitter.

9. A multi-point communications system comprising:

a plurality of remote service units each including a transmitter for transmitting OFDM/DMT symbols over a predetermined number of bins across a transmission medium and a receiver for receiving OFDM/DMT symbols from the transmission medium over a predetermined number of bins, each of the plurality of remote service units having a symbol alignment mode in which the transmitter of the remote service unit in the symbol alignment mode transmits a broad band periodic signal having energy in bins used for communication by other ones of the plurality of remote service units; and

a head end unit including a receiver for receiving the OFDM/DMT symbols and broad band periodic signal from the transmission medium, the head end unit further having a transmitter for transmitting OFDM/DMT symbols across the transmission medium, the head end unit using the broad band periodic signal to direct the remote service unit that is in the symbol alignment mode, via the transmitter of the head end unit, to align the symbol transmissions of the remote service unit that is in the symbol alignment mode with symbol

transmissions that the receiver of the head end unit receives from the other ones of the plurality of remote service units.

10. A multi-point communications system as claimed in claim 9 wherein the superimposed signal is transmitted at a period equal to the symbol rate.

11. A multi-point communications system as claimed in claim 9 wherein the broad band periodic signal is an impulse signal.

12. A multi-point communications system as claimed in claim 9 wherein the polarity of the broad band periodic signal is altered during the periodic transmission thereof.

13. A multi-point communications system as claimed in claim 11 wherein the polarity of the broad and periodic signal is altered on consecutive signals.

14. A multi-point communications system as claimed in claim 11 wherein the polarity of the impulse signal is altered during the periodic transmission thereof.

15. A multi-point communications system as claimed in claim 11 wherein the polarity of the impulse signal is altered on consecutive signal transmissions.

16. A multi-point communications system as claimed in claim 11 wherein the impulse signal is transmitted at a symbol rate of the formatted symbol frame.

17. A multi-point communications system comprising:

a head end unit disposed at a primary site, the head end unit including a transmitter for transmitting OFDM/DMT symbols over a predetermined number of bins across a transmission medium, the OFDM/DMT symbols being transmitted in periodically occurring formatted symbol frames, each formatted symbol frame having a cyclic prefix, the cyclic prefix having an impulse signal superimposed thereon, the polarity of the impulse signal being alternated on consecutive symbol frames;

a plurality of remote service units each including a receiver for receiving the OFDM/DMT symbols over a subset of the predetermined number of bins from the transmission medium, the receivers using the superimposed impulse signals to attain symbol alignment.

18. A multi-point communications system as claimed in claim 17 wherein the superimposed impulse signal is transmitted at a period equal to the symbol rate of the transmitted OFDM/DMT signal.

19. A multi-point communications system as claimed in claim 17 wherein the receivers apply a predetermined incremental phase shift to received samples corresponding to the received OFDM/DMT symbols to thereby compensate for phase shifts resulting from the cyclic prefix.

20. A multi-point communications system as claimed in claim 18 wherein the receiver comprises a lookup table to facilitate application of the predetermined incremental phase shift.

21. A multi-point communications system as claimed in claim 17 wherein the receivers attain symbol alignment by collecting digital data samples corresponding to the OFDM/DMT symbols, applying a sliding window equal to the length of the cyclic prefix to the digital data samples, and computing the total power in the samples of each window to determine which of the sliding window positions has samples of the greatest total power whereby the window position having the greatest total power corresponds to the time of occurrence of the cyclic prefix used by the receiver to align symbols received from the transmitter.

22. A transmitter at a head end unit disposed at a primary site in a multi-point communications system, the transmitter transmitting OFDM/DMT symbols over a predetermined number of bins across a transmission medium, the OFDM/DMT symbols being transmitted in periodically occurring formatted symbol frames, each frame having a cyclic prefix, the cyclic prefix having an impulse signal superimposed thereon, the polarity of the impulse signal alternating on consecutive frames, the impulse signals being provided to facilitate symbol alignment in remote receivers of the multi-point communications system.

23. A multi-point communications system as claimed in claim 22 wherein the superimposed impulse signal is transmitted at a period equal to the symbol rate of the transmitted OFDM/DMT signal.

24. A communications system comprising:

a transmitter for transmitting OFDM/DMT symbols across a transmission medium, the OFDM/DMT symbols being transmitted in periodically occurring formatted symbol frames, each formatted symbol frame having a cyclic prefix, the cyclic prefix having an impulse signal superimposed thereon, the polarity of the impulse signal being alternated on consecutive frames;

a receiver for receiving the OFDM/DMT symbols from the transmission medium, the receivers using the superimposed impulse

signals to attain symbol alignment of the received OFDM/DMT symbols.

25. A communications system as claimed in claim 24 wherein the superimposed impulse signal is transmitted at a period equal to the symbol rate of the transmitted OFDM/DMT signal.

26. A communications system as claimed in claim 24 wherein the receiver applies a predetermined incremental phase shift to received samples corresponding to the received OFDM/DMT symbols to thereby compensate for phase shifts resulting from the cyclic prefix.

27. A multi-point communications system as claimed in claim 24 wherein the receiver comprises a lookup table to facilitate application of the predetermined incremental phase shift.

28. A multi-point communications system as claimed in claim 24 wherein the receivers attain symbol alignment by collecting digital data samples corresponding to the OFDM/DMT symbols, applying a sliding window of fixed the length to the digital data samples, and computing the total power in the samples of each window to determine which of the sliding window positions has samples of the greatest total power whereby the window position having the greatest total power corresponds to the time

position used by the receiver to align symbols received from the transmitter.

29. In a multi-point communications system comprising a head end unit disposed at a primary site, the head end unit including a transmitter for transmitting OFDM/DMT symbols over a predetermined number of bins across a transmission medium, and a plurality of remote service units each including a receiver for receiving the OFDM/DMT symbols over a subset of the predetermined number of bins from the transmission medium, a method for allowing the receivers of the remote service units to attain symbol alignment comprising the steps of:

transmitting the OFDM/DMT symbols from the transmitter of the head end unit in a periodically occurring formatted symbol frame having a cyclic prefix;

superimposing an impulse signal at a fixed time position on the cyclic prefixes of the formatted symbol frames, the impulse signal having an alternating polarity on consecutive frames;

receiving the OFDM/DMT symbols and impulse signal at at least one of the plurality of receivers that is to attain symbol alignment;

detecting the time position of the occurrences of the impulse signals at the at least one receiver;

using the detected time position at the at least one to establish symbol alignment of the transmitted symbols at the at least one receiver.

30. In a multi-point communications system comprising a head end unit disposed at a primary site, the head end unit including a transmitter for transmitting OFDM/DMT symbols over a predetermined number of bins across a transmission medium, and a plurality of remote service units each including a receiver for receiving the OFDM/DMT symbols over a subset of the predetermined number of bins from the transmission medium, a method for allowing the receivers of the remote service units to attain symbol alignment comprising the steps of:

transmitting the OFDM/DMT symbols from the transmitter of the head end unit in a periodically occurring formatted symbol frame;

superimposing a coherent periodic signal at a fixed time position on the formatted symbol frames;

receiving the OFDM/DMT symbols and coherent periodic signal at at least one of the plurality of receivers that is to attain symbol alignment;

detecting the time position of the occurrences of the coherent periodic signals at the at least one receiver;

using the detected time position at the at least one to establish symbol alignment of the received OFDM/DMT symbols at the at least one receiver.

31. In a multi-point communications system comprising a plurality of remote service units, each remote service unit including a transmitter for transmitting OFDM/DMT symbols over a predetermined number of bins across a transmission medium, and a head end unit including a receiver for receiving the OFDM/DMT symbols from the transmission medium, a method for allowing the transmitter of a remote service unit to attain transmit symbol alignment comprising the steps of:

transmitting a broad band periodic signal from the remote service unit;

receiving the broad band periodic signal at the receiver of the head end unit;

detecting the time position of the occurrences of the broad been periodic signal at the receiver;

using the detected time position at the receiver to direct the transmitter of the remote service unit to transmit its symbols in alignment with symbols transmitted by other ones of the plurality of remote service units.

32. A communications system comprising:

a first unit including a transmitter for transmitting OFDM/DMT symbols across a transmission medium, the OFDM/DMT symbols being transmitted in periodically occurring symbol frames, a plurality of the

symbol frames each having a predetermined signal superimposed thereon;

a second unit including a receiver for receiving the OFDM/DMT symbols from the transmission medium, the receiver using the superimposed predetermined signal to attain symbol alignment of the received OFDM/DMT symbols.